Short Course
Robust Optimization and Machine Learning

Overview

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Course topics
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Let’s try again . . .

2. Robust optimization.
3. Machine learning applications:
   - *Unsupervised learning*: data analysis, covariance estimation.
   - *Supervised learning*: Model fitting, regression, classification, sentiment analysis.
4. Applications, mostly in text analytics.
Course outline

▶ Jan. 16:
  1. Lecture 1: Optimization models.
  2. Lecture 2: Convex optimization.


▶ Jan. 18:
  2. Lecture 5: Robust optimization overview.

▶ Jan. 19:
  1. Lecture 6: Robust optimization in supervised learning.
  2. Lecture 7: Sparse optimization for text analytics.
Speaking of slopes... An optimization problem you can think about while skiing

A two-dimensional skier must slalom down a slope by going through \( n \) parallel gates of equal width. The first gate’s middle position is \((0, 0)\); the \( i \)-th gate is separated by the previous one by a distance \( \sigma_i^2 \). We assume that the skier comes from uphill situated very far away from the start of the gate, with its initial direction set at a given angle.

![Slalom problem graph](image)

Slalom problem with \( n = 5 \) obstacles. “Uphill” is on the left side. Middle path in blue.

**Problem:** Find the path that minimizes the total length of the path. Your answer should come in the form of an optimization problem.